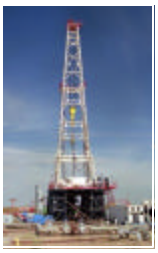

Monthly Report on 225C MWD
For June 2003

225C MWD Using SOI Electronics

Highlights

The first cell test of the new solid-state battery look promising.

We tested our first plasma sprayed solid-state battery cell. The cell output was 2.79 volts at 25°C and 2.98 volts at 300°C. The solid-state battery operates over an extremely wide temperature range. No other battery technology is capable of such a broad temperature range.

This test was not just testing a chemistry but also testing a new battery fabrication process using plasma spraying. It is hoped that the plasma spray process will greatly reduce fabrication costs and reduce the solid-state batteries inherent internal resistance. However, the internal resistance was not improved. In fact it measured an increase during this test.

Evaluation of the test cell showed oxidation on the anode material. The most likely cause was exposure to air prior to test cell assembly. Discussion is presently underway to either mechanically remove the oxidation or rebuild the anodes.

General Atomics is now moving forward on the solid-state battery

General Atomics has received exclusive licensing rites to the solid-state battery chemistry from DOE. General Atomics had been funding and working closely with the Russian inventor, Alexander Potanin. Unknown to General Atomics, Potanin had at some point taken DOE funding and used that funding to patent his battery technology. This confusion delayed General Atomics commitments to the program until they gained patent rites.

Now with the patent rites, General Atomics is now moving forward. They have signed a CRADA (Cooperative Research And Development Agreement) with Sandia and are 50% cost sharing .

Thermal Batteries

Eagle-Pitchard Industries (EPI) has completed their customer survey. They now have defined high-temperature battery goals and they are evaluating two possible battery solutions including the work being done at Sandia. They are shooting for a prototype next year. Sandia will continue its thermal battery effort in order to support testing in FY2004.

Task 1: Build and demonstrate SOI P/T tool in a long-term test at 175-200°C

In general, we are running late on the well installation. We are missing the wired tubing used to connect the tool to the surface. We should have it this week. We hope to get the tubing and tool fully tested and installed within the test well by the end of July.

Subtask 1.1: Completed. We have complete assembly and testing. The testing included two weeks of oven testing, one week at 180°C and one week at 200°C.

Subtask 1.2: We have about 99.9% of all the mechanical parts in house for the tool assembly. The Entran 300°C pressure sensors came in with the wrong seals. We are modifying the tool to fit the pressure sensors. This work should be complete today.

Subtask 1.3: Completed. The Navy has given us permission for a well in Coso, California.

We have contracted with Welaco Well Analysis Corp. They are out of Bakersfield where they work steam injection wells for Chevron-Texaco.

Issues related to Task 1

The Entran pressure sensors did not come in time for lab testing. We cannot place anything within the tool that has not undergone oven testing. We are building the tool to interface to the Entran pressure sensors and will deploy the pressure sensors after oven testing. This will provide us with an opportunity to evaluate the tool after several months downhole. (Keep in mind that we already have the Quartzdyne pressure sensor.)

Task 2: Build and laboratory test a hybrid battery system using two battery technologies: thermal for power and ceramic for keep-a-live.

This task is to build a 25-250°C battery. The proposed battery is a hybrid of a low current ceramic (25-250°C) used for retaining memory and program instructions while a thermal battery (150-250°C) carries the main current load while at temperature.

Subtask 2.1: We conducted a thermal battery test at 200 and 225°C. The battery worked well.

Subtask 2.2: The solid-state battery test was positive. The test cell operated from 25°C to 300°C. General Atomics has signed CRADA with Sandia. They are in the process of contracting a prototype production run for supporting well testing next year.

Issues related to Task 2

The solid-state battery test was not 100% successful. The internal resistance was high. It appears that oxidation had occurred on the anode. We are presently making plans on rebuilding the anodes or simply sanding off the oxidation.

Task 3: Design and field a testable "Memory Mode" MWD tool

Subtask 3.1: 90% completed. Steven Rountree at Diamond Research has completed his study of the azimuth reading at high temperature, 225°C. He is presently writing his report. It appears that conventional flux-gate magnetometers and SOI analog circuits is the best approach. The Honeywell SOI solid-state magnetic resistive devices have a high offset value making them difficult to calibrate.

Issues related to Task 3

The SOI inclination sensor needed to building a MWD directional module is running late. In fact, Silicon Designs has asked for a 6 month extension. The MEM inclination sensor is suffering from creep at 225°C. One of the conductive pads is creeping within a few hours causing an error in the inclination measurements. Silicon Designs is looking at other metals to solve the problem.

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